



A SPECIAL PUBLICATION OF
**The American
Association of
Amateur Astronomers**

**A Primer
for the Beginning Astronomer**

by John Barra
Peoria Astronomical Society

\$1.00

This publication is a set of five lessons designed to assist those who are just starting out in astronomy. These lessons might be equally instructive to those who have been trying for a few years to use their own telescopes but have had trouble finding objects that should be easy to locate. Though full of desire and enthusiasm for stargazing, they may have just gotten off on the wrong foot.

It does you no good to have a new telescope and a bunch of star atlases if you cannot find your way around the sky. My suggestion is this: put away your telescope at first and just learn the sky. If the temptation to use your equipment is too great, take your telescope out when the Moon is bright. Gaze at the Moon or at the easy-to-find planets of Venus, Jupiter, and Saturn. Then put away your telescope for the rest of the month and continue with this first lesson.

Lesson One

Learn the Sky

The first and most important step in learning the sky is to study the constellations. A good knowledge of the constellations is essential in order to learn how to starhop from object to object, an art that will be explained in a later lesson.

Purchase a simple star book that has constellation charts. *Observing the Constellations* by John Sanford or *The Audubon Society Field Guide to the Night Sky* by Mark R. Chartrand are two good choices. Both *Sky & Telescope* and *Astronomy* magazines, available on your local news stand, have monthly star charts. You should also buy a planisphere and a spiral notebook or other blank journal.

The only instruments you will need besides your eyes will be a pair of binoculars and a flashlight with a red lens. Just about any pair of binoculars you have will do for now. Before you purchase new binoculars that you expect to use in the future for more advanced stargazing, ask an experienced astronomer for buying tips.

You might have difficulty picking out the constellation stars from the rest in a rich, star-filled sky. So begin at a site that is not pitch black. After you learn the constellations is the time to go to the darker sites away from the city.

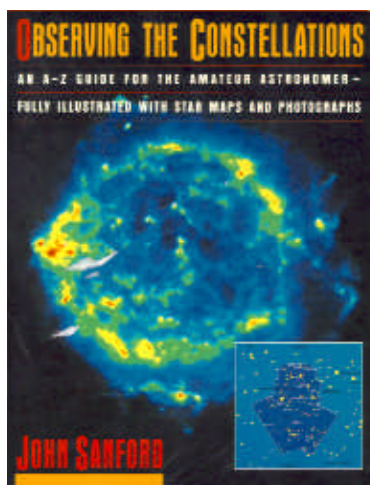
Go at your own pace. At first, study one or two new constellations a night, using your constellation chartbook as a guide. Learn their stars well and take the time with your binoculars to enjoy the general sky within each constellation. Your naked eye will be sufficient to find and learn some of the bright constellations such as Orion, Ursa Major, and Cassiopeia. You will need binoculars to see the dim ones such as Lacerta, Camelopardalis, and Cancer. Finally, you will use both the naked eye and binoculars to see constellations containing both bright and dim stars.

Don't expect to learn all the constellations at once. Many constellations are visible at night only during a particular season. Plan on taking nearly a year to learn all the ones visible in the northern hemisphere. Some constellations in the southern hemisphere, of course, are not viewable here at any time.



A planisphere will help you find your way around the sky any time of the year. The oval opening represents the heavens as seen from the latitude indicated on the moveable disk. On the edge of the disc are marked months and days, while greenwich time is indicated around the edge of the disk. Purchase a planisphere from any dealer of astronomical equipment.

Subscribe to *Astronomy or Sky & Telescope* magazine. Both magazines have regular monthly star charts, plus a calendar of what to view each month. A regular subscription to S&T is \$36.00 per year, but you can get it at the club discount through the AAAA for only \$29.95 per year. A regular subscription to *Astronomy* is also \$36 per year, but you can get it at the club discount for only \$29.00. To subscribe to either, or extend your current subscription, send a check for the correct amount to: AAAA - P.O. Box 7981, Dallas, TX 75209-0981



Purchase a simple star book that has constellation charts. John Sanford's *Observing the Constellations*, from Simon & Schuster, Inc., although hard to find, is a good choice. Wil Tirion's popular *Sky Atlas 2000*, available from Sky Publishing Corporation, is a good choice for most amateurs. Your naked eye will be sufficient to find and learn most of the bright constellations such as Orion, Gemini and Taurus.

Lesson Two

Learn the Movements of the Constellations through the Sky

As you watch the same constellations over a period of months, you will complete the second step in learning the sky: learning the paths that different constellations take across the sky. Study your planisphere to follow their patterns of movement. These patterns will help you learn which constellations are visible during different times of the year and how long they are visible for.

The constellations near the North Star are visible all year long. They are called circumpolar constellations. However, when such constellations are below the North Star (due north and near the horizon), they are more difficult to see. It is better to view them when they are east, south ("above"), or west of the North Star. Examples of circumpolar constellations are Ursa Major, Cassiopeia, and Cepheus.

Another group of constellations rise generally in the east, travel across the sky to a point near the zenith or directly overhead, and set generally in the west. They are best viewed when they are up high in the sky, between forty-five degrees above the eastern horizon and forty-five degrees above the western horizon. These constellations are visible during normal nighttime viewing for approximately half of the year. Among this large group of constellations are Hercules, Cygnus, and Leo.

Finally, there are other constellations that rise between the southeast and south and set between the south and southwest. They may be viewable only two to four months out of the year. Because they are always low in the sky, they are often harder to see. You may need to find an observing location that does not have city lights to the south to view these constellations effectively. Included in this group are Scorpius, Cetus, and Hydra.

You will soon learn other patterns. All the constellations are in our galaxy; however, those found along the galactic plane are considered to be in the "Milky Way." You will quickly see that these are much more dense with stars than the rest of the constellations. You will also learn the twelve constellations of the Zodiac. They, too, are found in the plane of our solar system, where you can also find the Sun, the Moon, and the planets.

Keep A Star Log

You should keep a journal or star log beginning with the first time you gaze at the stars. Such a log will record your progress. In future years, you will be able to look back with satisfaction at what you have accomplished. It will also remind you to take a second or third look at objects you viewed in the past and found particularly noteworthy. Your journal will tell you when the best time would be to view these objects.

Your log book doesn't have to be anything fancy. It may be as simple as a spiral notebook. In fact, that is what I used in 1991, when I started my avocation of stargazing by learning the constellations. It is what I still use.

I suggest you create a monthly calendar on the left-hand pages. You can make the calendars a month or two in advance. List the dates of the phases of the Moon and the dates of any special events such as eclipses or occultations. You might consider subscribing to *Astronomy or Sky & Telescope* magazine. They contain such calendar information.

Put on your calendar page a list of constellations or other objects you intend to study or view that month. You can then use the right-hand pages to record your observations. Your entry can be as simple or as detailed as you choose. You should at least record the date, time, and place of viewing; the sky conditions; and a brief description of what you viewed. You may also want to include a simple sketch from time to time. At first you will be mainly listing the constellations you have studied and viewed. You may also want to keep, on a separate page, a running list of constellations as you learn them. Before long you will be starting lists of other objects as well.

You'll be well on your way to learning the sky. At the same time you will also come to know the common names of some of the brighter stars within those constellations. Knowing them will also help you learn how to starhop. And soon you will be ready for Lesson Three.

Lesson Three

How to Use Your Telescope on Objects in the Solar System

You can learn to use your telescope by practicing on the Moon and the planets of our solar system. Planets will be the brightest objects in the area of the sky in which they can be found. Over a period of time, they will move from constellation to constellation. Once you have an object centered in any finderscope, look at it through the eyepiece.

These objects will take high power — the lower the number designation of the eyepiece, the higher the power or magnification. Practice moving the telescope while looking in the eyepiece to learn your directions.

The Moon: Use a low power eyepiece at first that will show the entire Moon. After capturing a particular area you want to view, you can change to one with higher power.

Start with a Full Moon. The darker areas are called mare or “seas.” The lighter areas are higher land formations including mountain ranges. Craters can be seen in both. Ejecta rays can be seen extending from certain craters. The most prominent rays extend from the crater Tycho. They should be easy to find.

As the Moon goes through its phases, a shadow travels across the lunar surface. The line where the illuminated area and the shadow meet is called “the terminator.”

Looking at it in your scope will provide many spectacular sights, particularly on mountain peaks and in craters. Near the terminator you may see the sunlight hitting a peak in a crater’s shadow to form a bright dot. Other times you can see a bright streak across a dark crater surface as the sunlight passes through a break in the crater rim. Soon you will become aware of what you can see best during each lunar phase. You may want to get a lunar map to assist in your exploring.

Venus: Venus never gets high above the horizon because its orbit is between Earth’s orbit and the Sun. It can be seen low in the west when it is in the evening sky and low in the east when a morning object. Venus follows a cycle of about ten months in the evening sky and ten months in the morning. Venus is easy to locate because it will be the brightest object in the sky except the Moon and Sun. Like our Moon, Venus has different phases that are interesting to observe.

Mars: It takes Mars about twice as long to orbit the Sun as the Earth does. Therefore it will be prominent in the sky every two years for about six months. The most prominent feature you might see is one of its polar ice caps. During those years when Mars is closest to us you should be able to see some of its other larger surface markings.

Jupiter: Jupiter takes twelve years to revolve around the sun. Therefore it can be seen in a different zodiacal constellation each year.

Jupiter’s four largest moons — Io, Europa, Callisto and Ganymede — are the planet’s

During the the year 2002, the planets are located as follows.

Jupiter is visible in evening sky in Gemini through May. It will be back in Leo in the morning sky starting in October, heading for opposition on Dec. 17.

Saturn can be seen in the constellation Gemini through May.

Mercury is always near the sun, visible in the twilight just before sunrise or just after sunset. During early May, look just after sunset, and again in October in the low pre-dawn sky.

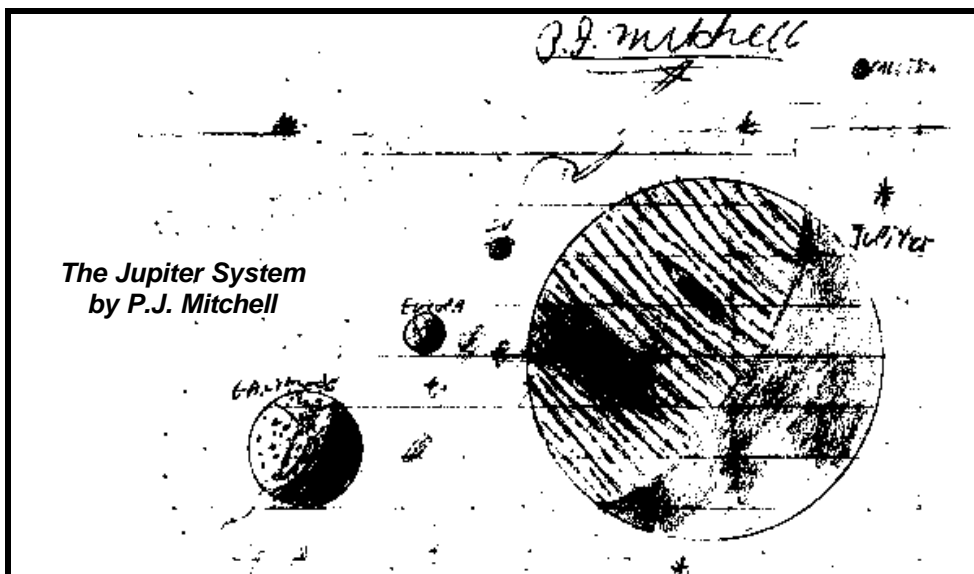
Venus is also always near the sun. From March through August, look in the evening after sunset. It will again be visible in the pre-dawn sky starting in December.

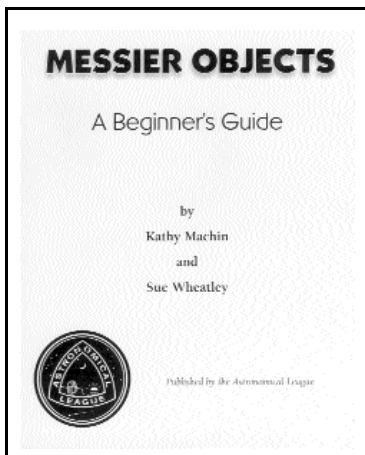
Mars disappears into the sunset by June and won’t be back until early December.



The moon is easy to view in first telescopes. Get a lunar atlas and learn the names of the craters. You may also earn the Astronomical League’s Lunar Observing Certificate. Lunar features are most easily visible along the terminator, the line dividing night from day.

Jupiter and its moons is a popular telescopic target. Its Galilean satellites are named Ganymede, Europa, Io, and Callisto. Artist and AAAA member P.J. Mitchell is a 14-year old science student in Oxford, Alabama.





MESSIER OBJECTS,
A Beginner's Guide
by Kathy Machin and
Sue Wheatley

available from
Astronomical League Sales
PO Box 572
West Burlington, IA 52655
30 pages, paperback, \$6.00 ppd.



Charles Messier listed 110 of the most beautiful objects available to amateur observers and their telescopes. AAAA members are eligible to earn the Astronomical League's Messier Certificate for observing all objects on the list, get a Certificate of Participation, and receive a beautiful Messier Club lapel pin. M42, the Great Nebula in Orion (above), is the most famous Messier object of all.

viewing highlights. Because their orbital planes are perpendicular to Earth's orbit, they appear as bright dots along a line. You can watch them move with respect to each other and Jupiter, hour by hour. At times, one or more of them may be unobservable while passing behind or in front of the planet. Other times they may become fainter or go dark altogether while being eclipsed by Jupiter.

On the planet itself the equatorial zones can be seen as parallel lines. You may be lucky and occasionally see the Great Red Spot.

Saturn: Saturn can be seen in a different constellation every two years. It is visible during the time the constellation is observable.

Saturn's ring system, when seen face on, is probably the most spectacular sight in the solar system. However, the ring plane becomes oriented vertically to us every 15 years. When it is thus viewed edge on, it can't be seen from Earth at all for a short time.

Such was the case in 1996. Shortly after that the rings appeared as one bright line. As the ring plane opened up you could see larger portions of the rings. In a small telescope, the rings appeared as one big ring. Other observable highlights are the ring shadow on the surfaces of Saturn and Titan, the planet's largest moon.

Mercury, Uranus and Neptune are more appropriately the subjects of advanced viewing, while Pluto is not observable in most backyard telescopes.

Lesson Four

Learn to Starhop

The easier it is to find deep sky objects, the more fun you'll have with amateur astronomy. You won't need setting circles or computers. All you'll need is your telescope, a finderscope, and a low power eyepiece. Add some star maps and you're ready to go.

The art of starhopping requires you to locate a naked-eye star near your target deep sky object. Put the star in the center of your finderscope. Then use one of the techniques explained below to locate your object. Any fair finderscope will work; I prefer the Telrad reflex sight because of its versatility. It's non-magnified but has three concentric illuminated rings: 4 degrees, 2-degrees, and 1/2-degree wide.

I will describe five starhopping techniques using different Messier objects as targets. You should use the lowest power eyepiece with the widest field of view that you have, to make it easier to locate objects. You can then switch to higher power as needed. Refer to your favorite star chart to find the general location of these objects.

1. In Line With Two Stars: The simplest technique is to "hop" from one star to another to your object. M31, the Andromeda Galaxy, can be quickly found using this technique. Aim your finder at the bright star Beta Andromedae. Then move your finder to another naked-eye star above it, Mu Andromedae. Continue to move your finder in the same direction, to a distance the same as the distance between the two bright stars. Now look in your eyepiece and you should see this great galaxy.

2. Between Two Stars: The small globular cluster M80 in Scorpius can be elusive but you should have no difficulty if you use this technique. Locate the two brightest stars in Scorpius: Antares (Alpha) and Beta. Aim your finder exactly halfway down an imaginary line between the two. M80 should be right there.

Vary this technique. Look at star atlases to see which objects lie on a straight line between two bright stars. Aim your scope the appropriate distance between the two, whether that distance is 1/2 or 2/3 or some other fraction that is easily approximated.

3. In A Triangle With Two Stars: While still in Scorpius, you can learn another technique by locating the large globular cluster M4. It forms an isosceles triangle with Antares (Alpha) and Sigma.

Aim your finder 1 degree below the center of a line between Alpha and Sigma, the longest leg, and at a right angle to it. If you have a Telrad, aim it so that the 2-degree circle touches the halfway point between the two stars. M4 should be in your view.

You can find many other patterns of triangles among two naked-eye stars and a deep sky object. For example, the galaxy M94 is approximately 2 degrees above and at right angle to the halfway point between the stars Cor Caroli (Alpha) and Beta, in Canes Venatici. Place the edge of the largest Telrad circle here.

4. At The Intersection Of Two Lines Of Stars: Some deep sky objects are not close

enough to a naked-eye star to use any of these techniques. However, they usually fall along lines between several pairs of stars that are farther away. Aim your finder where these lines intersect to find your object.

For example, M3 is on an imaginary line between Arcturus and Cor Caroli. It is also on a line that connects Epsilon Bootis and Beta Comae (Berenices). Point your scope to where these lines intersect. With a low power eyepiece, you should be able to see the bright cluster almost in the center of your view.

5. In The Eyepiece: To locate fainter objects, you will need to learn how to starhop through your eyepiece. Find a nearby bright star and aim your finder at it. Starting with your eye on the eyepiece with the bright star in the center, move the scope while following stars or star patterns to get to your target object.

To find the galaxy M108, aim your finder at Beta Ursa Majoris, the lowest star to the right in the bottom of the Dipper's bowl. You will notice two fainter stars near Beta in the eyepiece. Starting with the one nearest Beta, move your scope to Beta; keep going in the same direction about 2/3 of a degree to a brighter star. Continue on this line, passing two more fainter stars which are an equal distance apart. Follow the last star to another star close to it at a 135-degree angle. On that line, the same distance away as these last two stars are from each other, is M108. Making a right angle to the south, you will find a bright star 1 degree away. Within the eyepiece will be M97, the Owl Nebula.

As you become more experienced, get out your star atlas and pick objects to find. Look at the brighter stars or star patterns nearby and determine which technique to use for each object. Then have fun finding them.

Lesson Five

Planning an Observing Session

There are two rules in planning an observing session: make it simple and make it fun. In other words, your planning should help you spend the night enjoying objects rather than struggling to find them.

Deciding What To View

To decide which objects to view, obtain a planisphere to see which constellations will be observable that night. As a beginner, you may not feel confident to decide which objects to view. I suggest getting a beginner's book that does the planning for you.

MacRobert's *Star-hopping for Backyard Astronomers* is an excellent choice. He picks different areas of the sky and chooses ten or twelve objects in each section that are close together and within the range of the beginner. His sky charts and descriptions of the objects lead you through the session. *Turn Left at Orion* by Consolmagno and Davis is another good book. The deep sky objects in it are arranged in the order they appear in the sky. While its charts are not as easy to follow as MacRobert's, the drawings of how the objects look in the eyepiece are quite helpful.

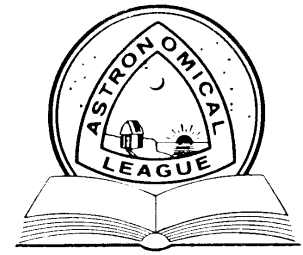
Another method is to pick a constellation and view the deep sky objects within it. I found the most useful book for this method is *Observing the Constellations* by Sanford. This book includes a chart of each constellation along with locations of the objects, a list of each prominent object with parameters such as size and magnitude, and a description of the best ones to view. Similar books I have found useful are *Peterson Field Guides: Stars and Planets*, *The Audubon Society Field Guide to the Night Sky*, and *The Observer's Sky Atlas* by Karkoschka.

A common way to choose objects is to use the famous Messier list. All the books I've mentioned include the Messier objects. Just pick which ones you'd like to locate each night. I have found *The Messier Album* by Mallas and Kreimer and *Messier Marathon Observer's Guide* by Machholz quite helpful in planning many Messier viewing sessions.

Finally, as you gain experience you may want to obtain the 3-volume *Burnham's Celestial Handbook*. While it doesn't contain star maps, it provides a tremendous amount of information on many objects and will help you choose targets for later observing sessions.

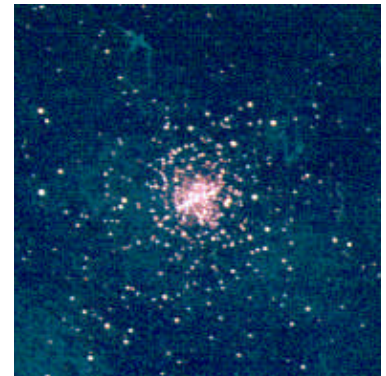
Preparing Star Charts

Most astronomy books (like the above) unfortunately are not good books to use in the

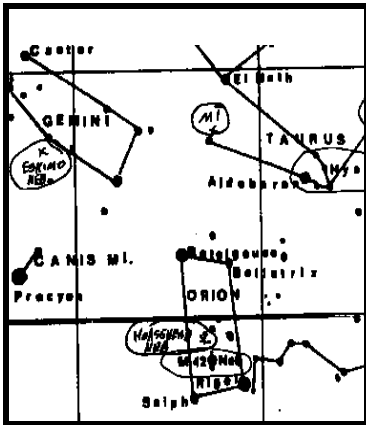


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Members of the Astronomical League may order any book on astronomy at a 10 per cent discount, through the Book Service. (Books sold through AL Sales cannot be discounted.) Just send the title and author of the book, the publisher and address if known, and a check made out to the Astronomical League Book Service for the retail price of the book less 10 per cent. Also give the name of your society, or state if you are a member-at-large, since this is a service for League members only. Send orders to: Paul Castle, AL Book Service 2535 45th St. Rock Island, IL 61201 (309) 786-6119



Deep-sky objects fall into five categories: galaxies, nebulae, planetary nebulae, globular clusters, and open clusters. Favorite telescope targets include (above top) M4, globular cluster in Scorpius, and M31, the Great Galaxy in Andromeda.



You can create your own star charts. Draw the bright, easier-to-locate objects and their constellations, or use a computer and one of the many stargazing-making programs available to print your charts.

Photocopy the observing form on page 7 as many times as you need, use it to record your observations, and file it in your observing notebook.

field. You'll need a good field atlas at the viewing site to aid in finding the objects you have chosen. There are many available; I personally use *Sky Atlas 2000.0* by Tirion. Its charts give the locations of most of the popular deep-sky objects. My laminated version is very handy for field use.

You can also create your own star charts. You'd be surprised how effective they can be. Draw the bright, easier-to-locate objects and their constellations, or use a computer and one of the many stargazing-making programs available to print your charts. Put your charts in clear page protectors, snap them in a three-ring binder; you'll have a great field book.

I use the program *Star Navigator* given with Meade telescopes. First I make a chart with a wide field of view. I locate the constellation and the object, and mark the closest naked-eye star to my object. Then I make a close-up chart containing the target star and my object.

Most programs are not good at reproducing the fainter stars, so I make use of my favorite resource, the two-volume *Uranometria 2000.0* by Tirion, Rappaport, and Lovi. Big and hardbound, *Uranometria* makes a lousy field book. However, it contains the fainter stars and as many deep sky objects as you would ever want. I locate those stars that are between my target star and the object and add them to my close-up chart. Other people have made great field charts by copying portions of pages from *Uranometria* and putting them in page protectors or laminating them.

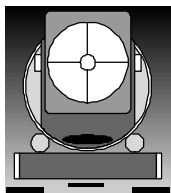
Documenting Your Viewing Session

As always, you'll want to document your observations. Some objects are verifiable merely by looking at them. However, many of these objects are dim; so you can't always be sure you are looking at what you planned to. I always draw the object and the stars I see with it in the eyepiece. A folded piece of paper or a notecard works fine.

Your drawings need not be exact; just show the object in relation to the stars nearby. When you get home, you can compare the rough drawing to the photographs or star charts in the books you have. If you have access to the Internet, try using the Digitized Sky Survey <<http://stdatu.stsci.edu/dss/>>. It contains photographs of the entire sky with all the deep-sky objects and the stars around them. The stars seen in most amateur telescopes appear bright and slightly spiked in DSS, making for easy comparison with your drawing.

Finally, memorialize your observing session with notes and descriptions in your star journal, as simply or as detailed as you want.

You may wonder when you'll have the time to look through the books, choose objects to view, and make your field charts. Remember all those cold winter nights or the many cloudy nights the rest of the year. That's when you plan for the few nights of good seeing to come.



Peoria Astronomical Society

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Telescopes
#397
Top View, W. Practor
D.S.S.

Amateur telescopes come in many sizes and shapes, but basically comprise two types, reflectors and refractors, in four categories. From top left, clockwise, a Newtonian reflector, a Schmitt-Cassegrain reflector, a Newtonian reflector on a Dobsonian mount, and a 60-mm refractor. A beginner's first piece of optical equipment, however, should be a pair of binoculars.



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AAAA Establishes Online Discussion Group

The American Association of Amateur Astronomers has started a new online discussion group, hosted by Yahoo! Groups.

The purpose of the group is to create a forum in which AAAA members can share ideas, experiences and challenges, ask and answer questions about astronomy, and just get to know each other. If you are an AAAA member or have an interest in amateur astronomy, we invite you and your friends to become a part of this Discussion Group. The Quad-A eGroup now has more than 120 members.

If you would like to join the AAAA discussion group, please send an e-mail request to: Quad-A-subscribe@yahoogroups.com or visit the web site at: <http://www.yahoogroups.com/list/Quad-A/info.html>

www.yahoogroups.com/group/Quad-A

Astronomical League Observing Awards

Messier Club Info

The newly rewritten League observing manual for the Messier objects is available from Astronomical League Sales, PO Box 572, West Burlington, IA 52655, 30 pages, paperback, \$6.00 ppd..

Observers should go through their club officers to obtain a Messier certificate. You do not need to send a copy of your Observing Log when your club requests a Messier Certificate. Only League Members-at-Large need to send a copy of their Messier observing log.

Send your requests for information about all AL observing awards to: *Scott Kranz, AL Observing Awards Coordinator, 106 N. Darroway DR, Raymore, MO 64083. (816) 331-5796. E-mail: skranz@worldnet.att.net*

Binocular Observing Club Info

For full details about the Binocular Messier Club, the Deep-Sky Binocular Club, the Double Star Club, the Urban Club, the Arp CCD Imaging Club, and the Southern Skies Binocular Club, including rules and regulations and complete lists of objects to be observed, send a Self-Addressed Stamped Envelope with \$.33 postage for each Club to: *Mike Benson, AL Binocular Club Coordinator, 2116 Crystal Drive, Nashville, TN 37210-3333. (615) 883-6571. E-mail: OCentaurus@aol.com*

Lunar Club Info

To participate in the Lunar Club and receive the Lunar Club certificate and pin, you need only observe a list of 100 lunar features. To receive full details on the Lunar Club, and a copy of the list of features to observe, send a business-sized Self-Addressed Stamped Envelope with \$.33 postage to: *Steve Nathan, Lunar Club Coordinator, 45 Brewster Rd., West Springfield, MA. 01089. E-mail: snathan@kl2.oit.umass.edu*